Fabric Reinforced Metal Matrix Composite, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The proposed research aims to develop a metal matrix composite (MMC) fabric that, when combined with additive manufacturing, will lead to weight reduction, increased structural performance, and reduce fabrication costs of structural components within launch vehicles. The approach focuses on developing a MMC fabric that will be used to selectively reinforce metallic components that are subjected to multi-axial forces while in service. The MMC fabric is able to be applied like traditional composite panels (i.e. multiple plies at different orientations) allowing for a tailorable reinforcement material that can be placed in the direction of the loading axes. By using a selective reinforcement additive manufacturing approach, the MMC fabric can be placed strategically within areas of high-stresses and only in these areas allowing for cost savings and weight reductions due to the need of less of the base material in these locations. The combination of the MMC fabric and additive manufacturing will lead to enhanced lightweight, cost-effective structures for various applications.

Anticipated Benefits

The effort has broad applications across many NASA missions. Stiffened structures exist in most launch vehicles, especially in the tank structures due to launch stresses and extreme temperatures. Any load bearing structure could benefit from a multifunctional, lightweight reinforcement material like the MMC Fabric proposed in this effort. Some examples of these structures are launch vehicles (present and future), crew vehicles, surface habitats, robotic explorers, or cryogenic tank structures.

Non-NASA applications include aircraft, ground vehicles, and aluminum ship designs. Commercial aircraft will benefit by utilizing MMC Fabric selective reinforcement concepts to reduce weight. The automotive market will benefit from MMC fabric by utilizing it in components such as aluminum and magnesium castings or flywheels for hybrid vehicles. The commercial aerospace industry could also incorporate the MMC fabric by using the material in launch vehicles and satellite components.

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Small Business Innovation Research/Small Business Tech Transfer

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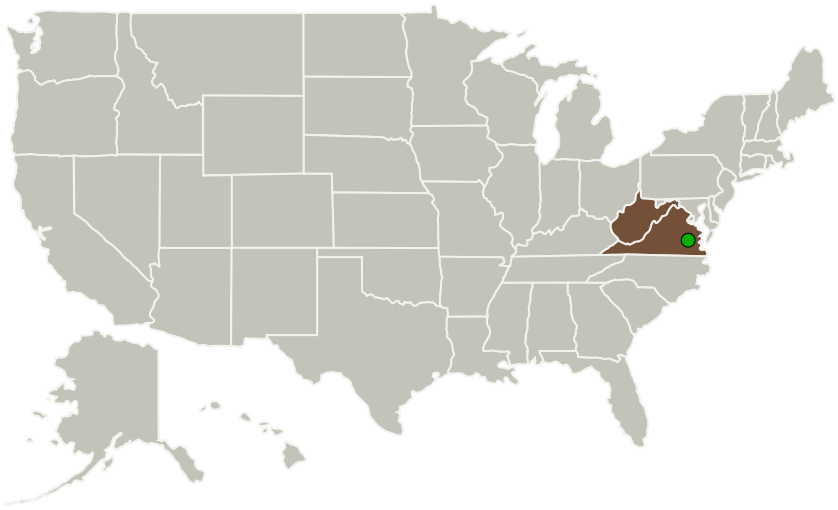
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Touchstone Research Laboratory, Ltd.	Lead Organization	Industry	Triadelphia, West Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Virginia	West Virginia

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141336)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Touchstone Research Laboratory, Ltd.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

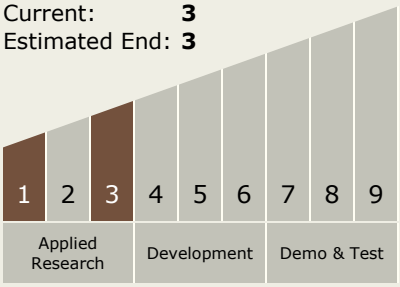
Carlos Torrez

Principal Investigator:

Brandon Coates

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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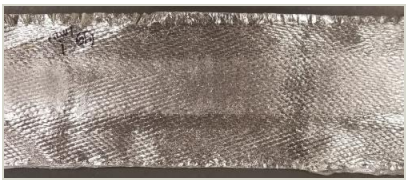
Images

Briefing Chart Image
Fabric Reinforced Metal Matrix Composite, Phase I
(https://techport.nasa.gov/image/134867)



Final Summary Chart Image
Fabric Reinforced Metal Matrix Composite, Phase I
(https://techport.nasa.gov/image/131921)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destination

Earth